Centrality, mobility and specialisation:
A study of drug markets in a non-metropolitan area in the United Kingdom

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Abstract

This paper empirically explores the structure and mechanisms underpinning the local drug markets in a non-metropolitan area in the United Kingdom. It relies on three years' worth of police records supplemented with qualitative evidence. It shows that, overall, supplying drugs is a rather fragmented business, yet there are indications of structural differentiation both in terms of positions and roles. Further, substantial differences emerge across drug types – with heroin and cocaine networks showing a higher tendency towards cooperation and group formation (higher average degree and lower fragmentation). This might be due to a higher need for protection and more complex supply chains. Drug suppliers tend to specialise in relation to the Class A drugs, their role in the market and the territory in which they operate. Finally, members of organised crime groups possess significantly higher degree centrality than non-members, suggesting an ability to exert influence on the market.

Keywords: drugs supply, centrality, mobility, specialisation, organised crime, network analysis

1. Introduction

The illegal drug trade is a lucrative, well-established market that features prominently on the global policy agenda (Bonfield, 2011). There is substantial agreement on the negative political, cultural, and economic effects of the illegal drug trade (Her Majesty's Government, 2017; McSweeney, Turnbull & Hough, 2008). The trade and use of drugs can cause serious harm to communities through drug-related violence, antisocial behaviour, acquisitive crime, and knife and firearms offences. For instance, in the United Kingdom (UK), there were 2,000 drug-related deaths recorded by the British authorities in 2012 (Her Majesty's Government, 2013). The social and economic costs of the illegal drug trade are assessed to be £10.7 billion per year, of which just over half (£6 billion) is ascribed to drug-related acquisitive crime (Her Majesty's Government, 2017). The UK drug market itself is estimated to be worth around £3.7 billion per year (Her Majesty's Government, 2013). In addition, it is reported that around half of all organised crime groups (OCGs) in the UK are involved in the drug trade (Her Majesty's Government, 2017). However, despite its relevance to large areas of public policy, there is still a paucity of research into the structure and mechanisms underpinning drug markets and the operations of drug distribution networks. This is particularly true in the case of the UK, where the majority of empirical research on the street-level drug trade is qualitative in nature, typically employing interviews with convicted drug offenders. However, individual traders often have a very limited view of the workings of the entire market. Additionally, studies analysing these networks have often amalgamated data on different drugs without considering the variances across markets. Furthermore, past research has typically looked at metropolitan settings, thus overlooking the workings of markets outside large metropolitan areas.

The aim of this paper is to expand on the existing literature by empirically investigating the structure of a local street-level drug market in a mid-size non-metropolitan urban area using a social network analysis approach. This study is supply-based, focusing exclusively on the supply side of the drug trade, as opposed to demand-based studies that focus on how drug users get their drugs (Potter, 2009). It aims to reconstruct the (offline) drug markets in Newport, Wales (United Kingdom) through the study of crime events as recorded by the Gwent Police Service. The evidence for this paper includes quantitative

data on co-offending as well as intelligence records on active organised crime groups. We supplemented this evidence with qualitative interviews with police officers working with the Gwent Police Service.

2. The Organisation of Drug Markets

An illegal drug market can be defined as a black market devoted to the cultivation, manufacture, distribution, and sale of drugs that are subject to drug prohibition laws (in line with Unodc.org, 2018). The definition of illegal drugs varies across countries due to different drug prohibition laws. In the UK, for instance, the majority of illegal drugs are controlled under the Misuse of Drugs Act 1971 and categorised into three separate groups of Class A, B, and C, with Class A inducing the most serious punishments and fines (Table 1).[1]

Table 1. The most common illegal drugs in the UK by class

Class A	**Class B**	**Class C**
Cocaine	Amphetamines	Anabolic Steroids
Crack Cocaine	Barbiturates	Benzodiazepines (Diazepam)
Ecstasy (MDMA)	Cannabis	Gamma Hydroxybutyrate (GHB)
Heroin	Codeine	Gamma-butyrolactone (GBL)
LSD	Ketamine	Khat
Magic Mushrooms	Methylphenidate (Ritalin)	Piperazines (BZP)
Methadone	Synthetic Cannabinoids	
Methamphetamine (Crystal Meth)	Synthetic Cathinones (e. g. Mephedrone, Methoxetamine)	

(Source: Gov.uk., 2018)

The drug seizure figures indicate that cannabis is the most seized drug in England and Wales, followed by cocaine. Benzodiazepine is the most seized Class C drug across England and Wales (Broadfield & Marshall, 2017; DrugWise, 2018).

How are these drugs supplied? In recent years, a growing body of research has investigated and explored the diverse structures of (offline) drug distribution systems, and how such systems operate at local, regional, national and international levels (Dorn, Levi, & King, 2005). Past research has commonly

[1] The present research only refers to drugs controlled under the Misuse of Drugs Act 1971. It does not include substances controlled under the Psychoactive Substances Act 2016. Additionally, it does not incorporate substances classified under the Temporary Class Drug Orders that cover the increasing quantity of new psychoactive substances that are not controlled under the Misuse of Drugs Act 1971 (Broadfield & Marshall, 2017).

found that drug trade networks differ in their size and complexity, ranging from hierarchical pyramid structures with clearly defined roles between members, to more fragmented, entrepreneurial, and non-hierarchical networks (May & Hough, 2004). Although drug supply enterprises are frequently portrayed as large and highly structured organisations, some evidence suggests a more complex picture (Dorn, Murji, & South, 1992). While media tend to portray drug markets as vertically integrated and controlled by a "Mr. Big", scholars have pointed to the "disorganised" nature of organised crime (Reuter, 1983). Illegal drug markets can be competitive with retail markets less structured than the international trade operations (Albini, 1986; Reuter & Trautmann, 2009). Some evidence suggests that, at the local and retail levels, drug dealing enterprises tend to be small and it is not uncommon for persons to operate as solo traders (Edmunds, Hough, & Urquía, 1996; Hobbs, 1998; Lupton et al., 2002; May & Hough, 2004). Some authors have described the suppliers as loosely organized clusters of people with involvement across different market levels or niches and relatively flat organisational structure (Natarajan & Belanger, 1998; Pearson & Hobbs, 2001).

Over the years, scholars have started employing social network analysis, combined with a variety of quantitative sources of data, to study the structure and dynamics of criminal enterprises involved in drug trafficking (Bright, Hughes, & Chalmers, 2012). Natarajan (2000, 2006) pioneered the use of wiretap transcripts, gathered during the prosecution of drug trafficking cases in court, to reconstruct the drug networks operating in New York, United States. Her results point to the existence of several different structures in the drug dealing networks, from solo dealers to hierarchical enterprises. Morselli and Petit (2007) analysed a hashish and cocaine importation network in Montreal, Canada. Using electronic communication transcripts, and found that several coordinators operated in the network, as opposed to a static central leadership. Furthermore, a study by Malm and Bichler (2011) employed Canadian police intelligence reports generated from 2004 to 2006 to examine the activities along the entire drug market commodity chain. They found significant differences in centrality and cohesion across market niches. More specifically, they found that individuals engaged in the production and sales were more likely to be characterized as small networks of entrepreneurs, whilst those engaged in smuggling and supply were more likely to be highly connected. Bright, Hughes, and Chalmers (2012) utilised judges' sentencing

comments to study Australian criminal groups involved in the manufacture and distribution of methamphetamine during the 1990s. They concluded that the network consisted of a relatively small number of members imbedded in a low-density network, which indicates a loosely connected network in which most participants have minimal contact with other participants. Calderoni (2012) looked at the internal organisation and division of labour within two Italian Mafia groups involved in international cocaine trafficking; this showed that high-status individuals tend to operate at an arm's length from drug-related criminal activities. Finally, Framis (2014) investigated the structure of cocaine trafficking operations targeted by Spanish police in four separate investigations and demonstrated the inherent flexibility across each operation, revealing that most of the groups (3 out of 4) had flexible and horizontal structures, as opposed to the more hierarchical and complex structures previously identified by the police.

Drug Markets in the United Kingdom

Studies that explicitly investigate the structure of offline drug dealing organisations in the UK remain scarce and often date back over a decade. Lupton et al. (2002) studied the heroin and crack cocaine retail drug market in eight deprived neighbourhoods in the UK. The qualitative evidence indicates that drug markets were operated by small networks with either hierarchical or loose entrepreneurial structures. Dorn, Murji, and South (1992) employed interviews with convicted drug offenders, police informants, and law enforcement personnel to examine the structure and organisation of upper level drug trafficking into the UK. The authors found evidence of a large variety of operations engaged in the trafficking of drugs, ranging from single individuals to tightly organised enterprises. Pearson and Hobbs (2001) examined the middle layer of the drug market by interviewing convicted drug dealers and law enforcement personnel. The results of the study indicate that the enterprises operating in the middle level drug market comprised of a small number of persons, often freely and openly trading with other groups of individuals. At the same time, it was not uncommon to find solo traders (Pearson & Hobbs, 2001). The Matrix Knowledge Group (2007) explored the distribution of drugs from the international level to the retail level. Similar to previous studies, this research employs interviews with offenders convicted of serious drug-related offences. The findings of these interviews suggest a large diversity in

the structures and operations of drug supply enterprises. However, the vast majority of the dealers described working in small or medium sized groups or collaborative networks, with a number working as single traders (Matrix Knowledge Group, 2007). The available evidence tends to be largely qualitative in its nature and often reconstructs the market from the perspective of those involved in the drug trade. However, interview data alone can only yield a partial and sometimes imprecise picture of the drug market. Individuals may have an incomplete understanding of the organisation of the drug market and an equally limited knowledge of the entire operation of an enterprise, particularly regarding upper-level bosses (Natarajan, 2000, 2006). Moreover, according to Bouchard and Morselli (2014), individuals have varying perspectives on what constitutes a group, group boundaries, and perceptions of organisations. Furthermore, the existing literature on UK drug markets neglects to differentiate between different types of drugs. However, it has been pointed out—notably by Reuter (2014)—that markets for different drugs may vary in their basic characteristics. According to Potter (2009), the structure and operation of drug markets are shaped by the drugs dealt within them, the characteristics of the suppliers, as well as the users and the context in which the markets exist. Finally, the application of social network analysis techniques to study the structure of drug markets in a more formalised fashion has not yet taken roots in the United Kingdom.

The Current Study

The aim of this study is to move beyond the existing qualitative assessment of the supply-side of UK drug markets by taking an empirical and systematic approach to reconstruct and model (offline) interactions among drug suppliers. This follows in the tradition of previous studies that have started using new data sources and social network techniques to further the study of organised crime and the drug trade (Morselli, 2001; Natarajan, 2000, 2006; Morselli & Petit, 2007; Malm & Bichler, 2011; Bright, Hughes, & Chalmers, 2012; Calderoni, 2012; Varese, 2013; Framis, 2014; Bright, Greenhill, & Levenkova, 2014; Natarajan et al., 2015; Campana 2016a, 2018). In addition, it offers a comparative analysis of different drug markets as well as an empirical assessment of the influence of organised crime groups and the interactions between organised crime members and other market participants. Finally, the present study will place the organisation of drug dealing into space and will examine offenders'

operations across multiple areas. Although offenders' spatial decision-making has received considerable attention in the criminological literature (see, e.g., Brantingham & Brantingham, 1991, 2008; Rengert et al., 2000; Wikström et al., 2010) such studies have mainly focused on a narrow set of criminalities such as burglary, often disregarding drug offenders (with the partial exception of Eck, 1992). In this work, we attempt to reconstruct the spatial patterns of drug supply in the geographical area under investigation.

This paper examines the offline local drug markets in a non-metropolitan urban area: Newport, Wales. The present study employs co-offending data and uses social network analysis to reconstruct the patterns of coordination, or co-offending, among individuals involved in the supply of drugs in Newport. Co-offending is defined as an act of committing a crime together with one or more partners (Carrington & van Mastrigt, 2015). Using fully anonymised police data, this study offers an in-depth understanding of the offline drug transactions in Newport by seeking to answer the following research questions: firstly, what is the structure of the supply-side of the drug markets in Newport, Wales? Secondly, what are the differences, if any, between different drug markets? Thirdly, what is the extent of product specialisation among suppliers? And of their geographical movements? Next, what is the involvement of organised crime groups in the drug markets? And, finally, what explains the centrality of actors operating in these markets?

3. Data and Methods

For this study, we rely on data obtained from the Gwent Police Service. Gwent Police is one of the 43 territorial police forces operating in England and Wales. The force ranks 18th (out of 43), or just below the UK average, on the number of organised crime groups known and mapped per million people (Her Majesty Inspectorate of Constabulary, 2017: 98). Gwent is a County located in the South of Wales, with a population of approximately 576,000 people. Newport is the largest city in the area with a population of 145,700 inhabitants (Office for National Statistics, 2017). Newport was chosen as the focal point of the study as it is the only large urban area in South Wales and it encompasses most of the drug activity in Gwent. Data from this study comes from two datasets extracted from Gwent Police database.

Description of Data

The first dataset contains all anonymised drug related offences that took place in Newport over three years, from April 2015 to April 2018. It includes fully anonymised information regarding 2,263 drug related offences linked to 1,888 unique crime events involving 1,685 individuals. The events in this dataset go well beyond co-arrest data and encompasses 28 different types of encounters with the police, primarily subject to caution, charge, community resolution, conditional caution, post requisition, failure to answer bail, fixed penalty, police bail, report to summon, stop-and-search, youth caution, youth conditional caution, and youth restorative disposal. It also includes instances where a person has been the driver of a vehicle that has been stop-checked, has been witnessed committing an offence, has been located in relation to an investigation or has been wanted. The original dataset was cleaned to ensure that an offender is linked to the same crime event only once, thus filtering out duplicates generated during the evolution of the investigative process (for example, a person might have been arrested and subsequently charged in relation to the same event). The original dataset includes the crime event ID, a recorded date for the event, the three-digit postcode, information about the offence as well as an anonymised individual ID, gender and age of the person at the time when the offence was recorded[2].

To separate persons involved in the supply of drugs from persons linked to possession offences, a new variable was created to recode the 'Involvement Type'. A person was classified as involved in supply if he/she was linked to one of the following offences: (a) Having possession of a controlled drug with intent to supply; (b) Permitting premises to be used for unlawful purposes in relation to a controlled drug; (c) Supplying or being concerned in supplying of a controlled drug; (d) Unlawful importation of a controlled drug under the Misuse of Drugs Act 1971. Furthermore, to allow for comparisons, offences were coded both in terms of the Drug Class (Class A, B and C) and Drug Type (e.g., heroin, cocaine and cannabis; see Table 1 for details). Further, following Malm and Bichler (2011), Bright, Greenhill and Levenkova (2014), and Bright et al. (2014) in their emphasis on the importance of understanding

[2] A person can appear in the dataset multiple times, meaning different ages will be recorded: only the first or lowest recorded age was considered in the analysis.

individual roles within drug-related criminal networks, we leveraged our data to identify and code three different types of roles based on the description of the offences committed: (a) producer; (b) importer; (c) dealer.[3] Additionally, a dichotomous variable indicating whether the offender was listed as a member of an organised crime group was also coded (see below).

The second dataset contains anonymised data relating to all active organised crime groups operating (or having the majority of their activities) in Newport. The dataset contains five different variables: an anonymised group ID, an anonymised person ID, gender and year of birth. The data available focused exclusively on the local and retail levels of the drug markets. The national and international connections among drug traders are not captured in our data. Finally, we supplemented our data with the evidence from semi-structured qualitative interviews with six police officers working with the Gwent Police Service to gain a more in-depth understanding of the mechanisms at play. All the officers had direct experience in conducting investigations into the drug market and sit at different level of seniority within the organisation (see Appendix for details). All the interviews were conducted face-to-face in Newport and lasted 50 minutes on average.

Data Analysis Procedure

Bichler, Malm, and Cooper (2017) aptly note that researchers must clearly explain how they generated the networks for social network analysis. Two different types of matrices were created to study the whole networks. First, we created a two-mode matrix 'Actor-to-Event' based on the police data. Second, we converted that matrix into a one-mode matrix 'Actor-to-Actor' which captures co-participation in crime events. A link exists between actors if they were involved in a crime event together. We followed the same strategy to study the movement of drug suppliers across space. We first created a two-mode matrix 'Actor-to-Postcode' and then converted it into a one-mode matrix 'Postcode-to-Postcode'. This means that a tie or a link exists between two postcodes if a person has been linked to an offence in both postcodes. By construction, the ties of both one-mode networks are undirected. Ties are weighted,

[3] On drug-related roles, see also McSweeney, Turnbull and Hough (2008: 22); on the importance of roles in criminal networks other than drugs, see also Campana 2016b.

meaning that they capture the strength of a relation, i.e. the number of times two individuals were recorded participating in crime events together or the number of individuals two postcodes share. Both network-level measures and node-level analysis have been carried out. Additionally, OCG members were identified in the main network matrix in order to create the ego network for each OCG members. These networks are undirected and weighted.

Limitations

This study is not without limitations. Inevitably, an analysis that is based on police information will, to some extent, reflect the perception of law enforcement agencies (Calderoni, 2014; Nagin, Farrington & Moffitt, 1995). Police recorded incidents are influenced by the activity of the police as well as changes in recording practices, resource constraints and recording practices (Massari, 2006; Potter, 2008; Broadfield & Marshall, 2017; DrugWise, 2018). Moreover, a substantial amount of crime goes unrecorded, often referred to as the 'dark figure of crime' (Coleman & Moyniham, 1996). The drug trade is often viewed as victimless, whereby the persons involved, either in the supply of drugs or consuming drugs, are unlikely to report the crime to the police—as opposed to victim crimes, such as burglary. Thus, for the police to have a record of a crime taking place, a proactive investigation action must be employed. Furthermore, due to the secondary nature of the evidence, it was not possible to control for data error and missing data (e.g., due to the impossibility of manually surveying the whole population of offenders; Malm, Kinney & Pollard, 2008).

However, in light of other studies of criminal networks, we believe that police data still remains an important and fruitful source of information to study the structure of drug operations (Natarajan, 2000, 2006; Morselli & Petit, 2007; Campana 2011, 2016a, 2016b, 2018; Malm & Bichler, 2011; Bright, Hughes & Chalmers, 2012; Varese, 2013; Bright, Greenhill & Levenkova, 2014; Calderoni, 2014, Framis, 2014; Natarajan et al., 2015). McGloin (2005) elicited information on interactions among gang members and their associates from the experiential knowledge of police officers, and then analysed this evidence using social network analysis. We follow in this tradition of studies. We had extensive discussions with members of the proactive investigation department (Interviews 2 and 3) to ascertain

whether police priorities in relation to drugs have shifted considerably over the period under consideration, and the answer is in the negative. Further, we took a number of decisions to minimise the impact of potential biases: we adopted a broad definition of what constitutes an event (going well beyond co-arrest data), we collapsed three years' worth of data into a single cross-sectional dataset and treated the resulting networks as dichotomous (i.e., presence or absence of ties only). Due to the limitations of the data employed, we only examined the quantity of contacts without regard to the quality of the contacts. While some of the limitations intrinsic to police data still apply, we believe that these steps have helped us mitigate the impact of some of the issues discussed above.

4. The Drug Market in Newport

Police records show that the three years between April 2015 and April 2018 have seen 1,685 individuals operating in the drug market in Newport. These individuals are connected to 1,888 unique crime events which, in turn, are linked to 2,263 drug related offences. The majority of offences are linked to Class B drugs (66.0%). Class A drugs accounts for 31.7% of all offences, and only 2.3% of offences are Class C related (Table 2). There are 18 different types of drugs linked to all the recorded incidents. Most drug offences are linked to cannabis (58.4%), which explains the prominence of Class B. The second most prevalent drug type is heroin that accounts for 15.3% of all offences. Cocaine is linked to 10.3% of all offences.

Table 2. Percentages of all recorded drug types based on crime events

Drug Type	**Drug Class**	**Percentage (Count) of Incidents**
Heroin	Class A	15.3% (347)
Cocaine	Class A	10.3% (232)
Other Class A	Class A	2.8% (64)
Crack	Class A	2.6% (59)
Methadone	Class A	0.4% (9)
MDMA	Class A	0.2% (4)
Crystal Meth	Class A	0.1% (2)
Total Class A		*31.7% (717)*
Cannabis	Class B	58.4% (1322)
Amphetamine	Class B	5.4% (123)
Mephedrone	Class B	1.4% (31)
Other Class B	Class B	0.6% (14)
Synthetic Cannabinoid	Class B	0.1% (3)
Total Class B		*66.0% (1493)*
Other Class C	Class C	2.2% (47)

Piperazines	Class C	0.1% (2)
Anabolic Steroids	Class C	0.1% (1)
Ghb	Class C	0.1% (1)
Ketamine	Class C	0.1% (1)
Khat	Class C	0.1% (1)
Total Class C		*2.3% (53)*
Total		***100% (2263)***

Police records separate crime events related to possession of drugs from those related to supply. In Newport, the former constitutes the majority of offences (61.5%) while supply-related (strictly conceived) offences account for 38.5% of the total drugs events. This is in line with the expectation set out by Reuter (2014). Yet, different classes of drugs show different patterns. For Class A drugs, the majority of offences is supply related (60.8%, N=436). The opposite is true for Class B (71.1%, N=1,061) and Class C (94.3%, N=50) drugs, where the majority of offences are associated to possession. In the remainder of this work we will only focus on the supply side of the drug markets in Newport, and thus disregard possession associated incidents.

Overall, there are 650 individuals linked to drug supply incidents in the Newport area. The majority of them are male (87%). The average age is 29 years old. Almost half of the individuals (42.9%) are aged 20 to 29 years old. In terms of roles, the majority of individuals involved in drug supply are dealers (67%, N=435). One-third of the actors are linked only to the production of drugs (30%, N= 198) while a handful of individuals are only involved with the importation of drugs (1%, N=7).[4] There appears to be a very high degree of specialisation across roles, with only 2% of the actors having more than one role (typically dealing and either importation or production).

Producers tend to be overwhelmingly linked to Class B&C drugs (95%), namely cannabis, while importers tend to be linked to Class A (71%).[5] Dealers, on the other hand, are split: 41% have dealt with

[4] The very few cases of production of Class A drugs are likely o be related to the cutting of drugs after importation (Interview 2 and Interview 3).

[5] For evidence of cannabis production in the Newport, see Knapman, 2019; South Wales Argus, 2019; Williams, 2019.

Class A only while 38% with Class B&C only. Once again, a specialisation in terms of drugs seems to emerge with just 20% of dealers handling both Class A and Class B&C (Table A1 in the Appendix).

To what extent have drug offenders established relationships in Newport? And what does the structure of these relationships look like? Police records can offer only a partial answer to this question. However, some preliminary insights can be successfully drawn. Of the 650 individuals, 45.5% have been associated with a crime events without any co-offender (in network terminology, we define them as 'isolates'). Figure 1 presents the relationships underpinning the supply network of drugs in Newport. The dots represent actors and the ties indicate co-participation in a crime event. The colour of the nodes indicates the role within the drug market.

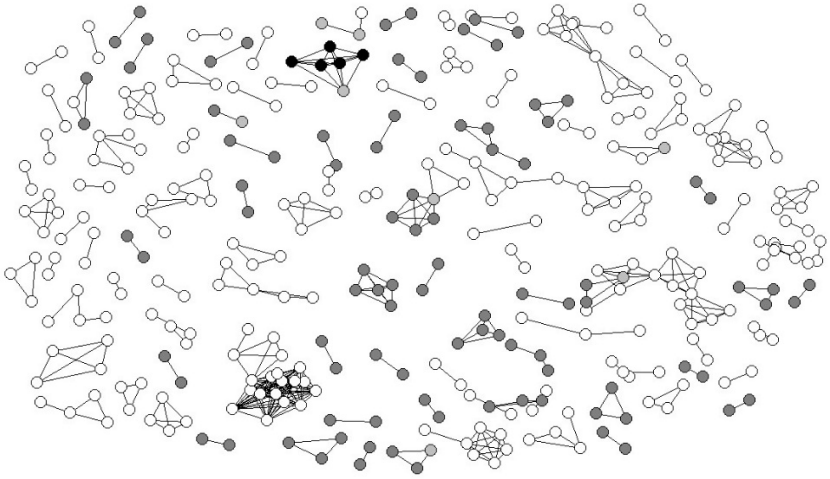

Figure 1. The supply of drugs (all drug classes) network
Note: colour of the nodes, white = dealer; dark grey = producer; black = importer; light grey = multiple roles. Isolates excluded for the picture.

On average, nodes have 2.5 ties between each other and fragmentation is rather high (0.989, close to the theoretical maximum of 1). Yet, some structure can be detected in the network. There are 119 components, some of which form dense co-offending clusters. An analysis of the degree centrality reveals that 2.4% of nodes have more than 10 connections and 2.8% have between 9 and 5 connections (Table A2 in Appendix). This suggests the presence of a few central and better-connected actors in the network.

We have already noted that different drugs show different patterns in relation to supply *vs.* possession charges. When it comes to the structure of the market, do different drugs show different organisational patterns? We now turn to explore this issue.

5. Comparing Drug Markets

In this section, we compare the supply-side of different drug markets. Firstly, individuals operating in all drug markets do not show any major differences in terms of gender (89% of Class A offenders are male compared to 87% in Class B and C) and age (27 years for Class A; 29 years for Class B and C).[6] For all classes, the largest age group was 20 to 29 years old (44% for Class A and 42% for Class B and C). However, offending patterns do differ across drug classes. Crucially, individuals involved in Class A supply appear to have a higher level of re-offending, if we measure the latter based on the number of times a person is linked to an incident in our dataset. While 92.4% of Class B and C suppliers only appear once, this percentage drops to 72.8% for Class A drugs.[7] What about the structure underpinning the supply-side of such markets? To gain a more nuanced picture, we focus on the three main types of drugs supplied in Newport as captured by the police data: heroin, cocaine and cannabis.

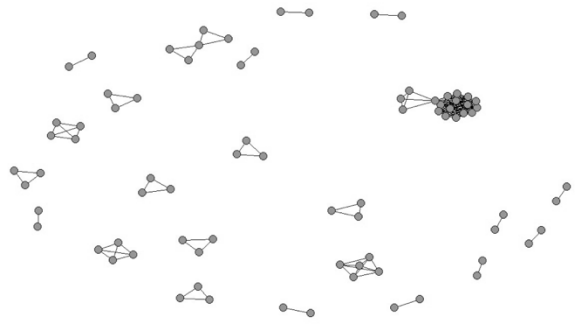

Figure 2a. Supply of heroin network

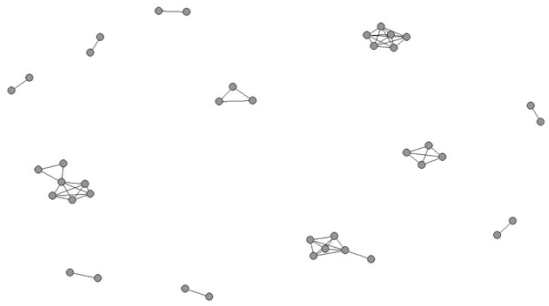

Figure 2b. Supply of cocaine network

[6] Due to the limited number of cases, Class C drugs have been combined with Class B.
[7] The number of times a person was linked to the supply of Class A Drugs is higher than compared to Class B and C: the maximum number of offences is 12 for Class A and 5 for Class B and C; the mean for Class A is 1.55 and for Class B and C is 1.09.

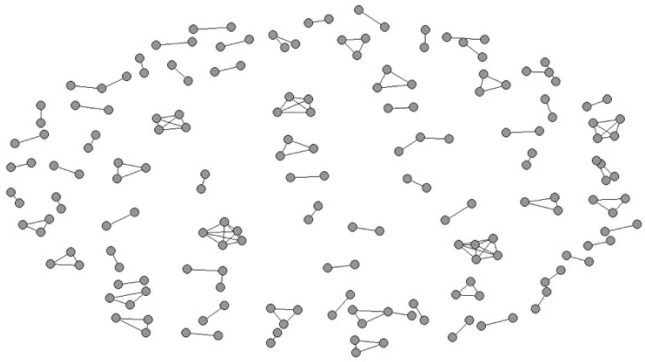

Figure 2c. Supply of cannabis network

The supply network of cannabis is the largest among the three with 367 nodes (Figure 2c); heroin follows with 160 nodes (Figure 2a) and, lastly, cocaine with 74 nodes (Figure 2b). The prevalence of heroin over cocaine in the Newport drug market is confirmed by several police officers we have interviewed: "I've got two jobs [live investigations] at the moment, one is 5 kilos of heroin from one address and one for a kilo of heroin… In the last three weeks alone, we have probably come across somewhere in the region of about 7 kilos, 8 kilos of heroin. So quite substantial amounts of heroin" (Interview 2). "Newport is the hub for cheap heroin" (Interview 1), and this is linked to lower-than-average prices: "It is widely recognised throughout South Wales, ever across the country, that if you want heroin you go to Newport, because the cost is significantly lower. We have got instances of people travelling from West Wales [to buy heroin]" (Interview 4). The same interviewee explains: "Cocaine hasn't traditionally been very popular, but we are seeing an upsurge. Cocaine market is expanding recently due to the drop-in price. Cocaine has traditionally been too expensive for South Wales, it is a deprived area and people couldn't afford paying 50 to 100 pounds per gram. But now that it is dipping to 30 to 40 pounds, there has been a bit an upward surge in cocaine" (Interview 4). What about the structure of such networks? Some differences in structural features emerge.

Table 3. Network level measures by drug type

Network Measures	**Heroin**	**Cocaine**	**Cannabis**
Average Degree	4.33	2.75	1.58
Density	0.056	0.071	0.009
Components	23	12	74
Fragmentation	0.930	0.914	0.991
Size	160	74	367

Firstly, heroin and cocaine networks show a (comparatively) much higher level of density and a much lower level of fragmentation than the cannabis network. While the overall density might be influenced by the size of the network, average degree is normally viewed as a more robust measure when comparing networks of different sizes (Borgatti, Everett and Johnson, 2013). On average, suppliers in the heroin network have a much higher degree (4.33) than cocaine (2.75) and particularly cannabis (1.58). This indicates that, on average, heroin suppliers have almost three times more ties than the cannabis suppliers, and cocaine suppliers almost twice as much than cannabis suppliers.[8] Furthermore, elements pointing to a higher structural complexity structure in the heroin and cocaine networks compared to the cannabis networks come from a comparative analysis of the distribution of degree. While 27% of the nodes in the cocaine network and 20% in the heroin network have at least three or more ties, this percentage drops to 7.6% in the cannabis networks.

The comparatively lower degree of fragmentation and higher average degree are consistent with the idea that dealing in such drugs requires more cooperation and, potentially, a tendency to form groups. We can only offer some speculation here as to why this might be case. Firstly, a higher need for protection. Research suggests that 'soft drugs' are more likely to be traded in closed markets while 'hard drugs' are more associated with open and street markets (Potter, 2009). Arguably, the latter may involve greater security risks. As studies have shown, cannabis trade attracts less violence than heroin and crack trade (Coomber & Turnbull, 2007; Reuter, 2009; Coomber, 2015). The customer base also differs between 'hard drugs' and 'soft drugs', with the former more likely to be associated with addiction and thus more prone to violence (Potter, 2009). Markets for Class A drugs appear to be characterised by a greater need for protection, and a group – or at least greater and tighter cooperation among suppliers – may be a response to this. Secondly, the complexity of the supply chain – with the cannabis often produced locally or domestically while heroin and cocaine are produced further from the main consumer markets (EMCDDA & Europol, 2016; Hough et al., 2003; Bouchard, 2007; Potter, 2007). Both points are

[8] The number of isolates is similar for the cannabis (51%) and the heroin (50.6%) networks, and it is slightly lower for the cocaine network (46%). Isolates are not included in the network pictures presented.

reflected in the interviews conducted in Newport. As one experienced police officer put it to us, when dealing in Class A drugs, being a member of an organised crime group "makes obtaining the product easier, cheaper and safer, and their own personal security is taken care of. If you are a lone wolf, you don't have a support network" (Interview 2). The type of market, i.e. closed *vs.* open, also plays a role: "If you are a lone wolf operating alone on a street corner and an OCG doesn't like it, you have nothing to prevent that from happening and they will come and muscle in and you are gone within a matter of minutes. Whereas if you have got the power of an OCG behind you, you have got an army, then you are in a more powerful position" (Interview 2).

6. Offenders Specialisation and Movement

How specialised are drug markets? To address this question, we looked at whether each individual in the dataset has dealt with a mix of Class A and Class B&C drugs, or just one of the two. The evidence suggests that individuals tend to specialise by class in their dealings: only 15.5% of the suppliers have dealt with both classes in the period under consideration (29.7% have dealt with only Class A drugs and 54.9% with only Class B&C). We further investigated the extent of specialisation by considering specific drugs: namely heroin, cocaine and cannabis. Among the suppliers specialized in Class A, 50.8% (98) exclusively dealt in heroin, 19.2% (37) in cocaine, and only 5.7% (11) dealt in both. When considering Class B&C, the majority of individuals (94.0%) dealt solely in cannabis. Interviews with police officers support these findings: "They tend to stick to what they know. If they are a cocaine OCG [organised crime group], they will remain a cocaine OCG." (Interview 4). According to another interviewee, "They would normally stick to a single type of drug. They will stick to heroin if they are heroin dealers, that is all what they will deal, they won't branch out and deal other [Class A] drugs" (Interview 3). Switching between drugs or expanding into a new drug market is not an easy task, and it comes with considerable costs. For example, for a cocaine OGC "to try to muscle into the heroin market would require a new series of contacts and a whole new distribution network to establish. Without mentioning that they will be stepping on to somebody else's toes" (Interview 4). The result is then a high degree of specialisation, particularly in relation to Class A drugs.

Next, we move to assess the mobility of the suppliers within the Newport Area. To do so, we looked at the geographic movement between crime events. The data supplied to us contained information detailing the first three digits of the postcode where the recorded incident took place. The data we possess are rather local in scope covering only the East Local Policing Area in Gwent, that is Newport and Monmouthshire. In the three-year time frame, all the incidents recorded in the police system for which we have geographical information are linked to 6 3-digit post codes.[9] Events tend to cluster around certain postcode areas, for example 51.9% of events are linked to NP20 and 35.9% to NP19. All the other postcodes only account for 12.2% of all offences. Interestingly, there appears to be some level of geographical specialisation with heroin and cocaine more associated with NP20 than N19 and the opposite for cannabis.

Finally, we looked at the mobility of suppliers. To minimise biases due to the data collection by the local police, we have decided to exclude from the analysis any postcode outside the Newport area and focus only on the movement within the Newport area. Overall, suppliers show a very limited mobility: the vast majority of them were only linked to one postcode (88.5%). Only 10.9% of suppliers operated across 2 postcode areas and 0.6% across 3 areas. No one operated across more than three postcode areas. These findings resonate with the experience of police offices: "From my experience, they [the offenders] tend to stay in their own particular area. For example, here [the area where the police station is located] is a traditional heroin market. […] On the other side of the river, you will have the cocaine and the amphetamine markets. There is a natural divide that separates the two [markets]" (Interview 4). A second interviewee made a similar point: "They [the offenders] tend to stay on the one side or the other of the river, that is East or West of Newport. They tend to stay within certain areas of those areas too. Both for runners and the core. You wouldn't get runners of an OCG from Somerton operating in Pill" (Interview 5).

7. The Involvement of Organised Crime

[9] This does not include the 0.01% of drug supply related incidents that had missing post code information.

We now explore the involvement of organised crime groups (OCGs) in the Newport drug markets. Gwent Police, the local police force, compiles a list of OCGs active in the area. This list is based on intelligence gathered by the force and constantly reviewed (Interview 5). The anonymised dataset we were granted access to includes information regarding eight OCGs identified by the police[10]. These groups are comprised of 55 members in total. The average number of members is seven, the minimum is four, and the maximum is ten. The majority of listed members are male (91%). The average age is 31 years, which is slightly higher than the general drug market. The average age does not vary substantially across OCGs. The minimum age is 15 years old and the maximum age is 55; 40% of members are below the age of 30. Roughly half of OCG members (44%) were linked to drug incidents (this is in line with the UK estimate of around half of all OCGs being involved in the drug trade: Her Majesty's Government, 2017)[11]. In terms of drugs, the majority of OCG members liked to supply has dealt with heroin (57%), followed by cocaine (33%) and cannabis (23%).[12]

Figure 3 shows the ego-networks for the 19 OCG members who have co-offended with another individual in the period under consideration. Seven separate components emerged from the analysis.

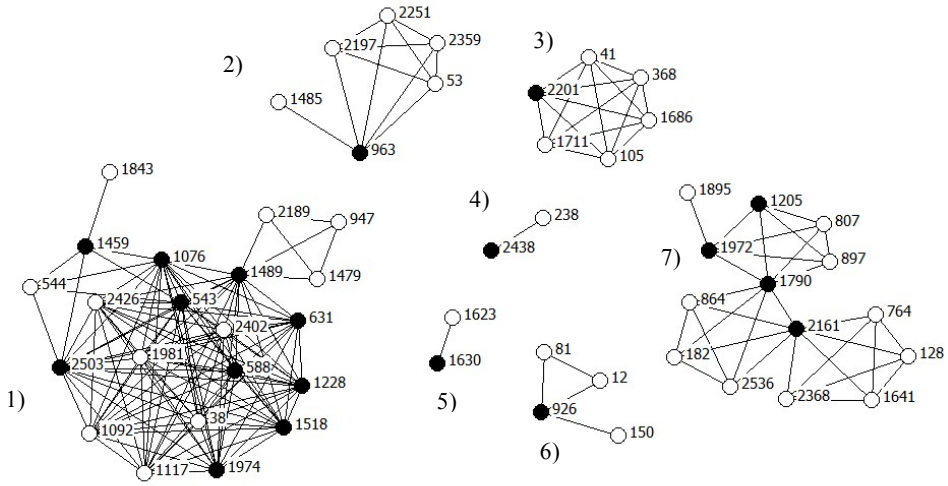

Figure 3. Ego networks of OCG members by component
Note: Black dots: OCG members; White dots: Non-OCG members

[10] These were all the groups currently under police surveillance that were primarily involved in the supply of drugs in Newport area
[11] The vast majority (87.5%) of OCG members were involved in the supply of drugs with only three members linked uniquely to possession charges.
[12] The percentage count exceeds 100 as actors can deal with multiple drugs.

The analysis reveals some interesting findings. In Component 1, all members except 1459 belong to the same OCG. Component 7, for instance, involves 4 OCG members: however, ID1972 and ID1205 belong to one OCG and ID1790 and ID2161 belong to a separate OCG, suggesting some level of cooperation between these two groups, or at least between their members (based on the evidence available, it is impossible to establish whether cooperation is centrally sanctioned, or it is the result of individual decisions). In Component 5, ID1630 is a member of the same OCG as ID1790 (Component 7) and ID1459 (Component 1). Yet, cross-group cooperation is not always the rule. In Component 2 and 3, ID963 and ID2201 are both members of the same OCG. Finally, OCG members from Component 4 and 6 are both in the same OCG, but they have developed separate, unconnected ego-networks. Finally, in terms of centrality in the broader network, what is the position of OCG members? Do they occupy a higher, more central position than non-OGC members?

Table 4. T Test for difference in centrality between OCG member and not members

	Group 1: Non OCG Members	**Group 2: OCG Members**	**Difference in means**	**One Tailed T-Test Group 2 > 1**
Average Normalised Degree Centrality	0.773	1.667	-0.894	0.030

Table 4 presents the result of a t-test of the difference in means between drug suppliers who belong to an OC group and whose who do not. On average, OGC members tend to have a higher normalised degree centrality (1.667) than non-members (0.773).[13] This difference in means (-0.894) is statistically significant. This result is consistent with the idea of a hierarchy within drug markets, with OCG members more likely to be placed at a higher level in such a hierarchy. [14] One interviewee describes the arrangements within the market as follows:

> Normally there is the core of the gang that mainly consists of 1 to 3 people who control the drugs. Under that we can see the lieutenants and then the lowest in the hierarchy are the runners

[13] The dataset used for the analysis included all involvement types, given the small N of the OCG members.
[14] A separate issue relates to hierarchies within each OGC. Our data are not granular enough to explore such issue. Anecdotal evidence from our interviews describes OCGs as possessing "structure and hierarchy" (Interview 2) or, as another interviewee put it, "there is a structure and a clear hierarchy" (Interview 6).

> of the drugs. Additionally, we see OCGs using people to store drugs in their homes in exchange for money, often exploiting vulnerable people (Interview 1).

This is echoed by a second officer who described a similar structure (Interview 5). Class A drugs appear to be "imported" into Newport from bigger cities, such as Liverpool, Birmingham or London (Interview 5), with the occasional package coming directly from abroad (e.g. Pakistan, Interview 6). Large shipments of Class A drugs into Newport tend to be organised and controlled by OGCs (Interview 4). As described by another officer, there tend to be different levels in the market: Newport-based OCGs would buy the drugs from higher-up OCGs based in bigger cities like Liverpool, then "they would have their own little empire [in Newport] and they use another team below them to make the drugs or package the drugs for the runners to go out and sell them" (Interview 3).

8. Predicting Centrality in Drugs Market

We now turn to our final question: what makes an individual a central player in the supply of drugs? Table 5 presents the results of a regression model looking at the impact of all the variables we were able to code based on the police recorded degree centrality[15]. These variables include the age, gender, and OCG membership of an individual as well as the spread of their geographical reach, the type(s) of drug supplied and their role in the drug market.[16] For the analysis, we relied on a node-level multiple regression model with a permutation test of significance (for the test, we used the routine implemented in UCINET: Borgatti, Everett, & Freeman, 2002).

Table 5. Determinants of Degree centrality

	Degree Centrality		
	Coeff.	St. Err.	Sig.
Age	0.001	0.003	0.711
Gender (1=F)	0.056	0.080	0.493
No of Post-codes	0.068	0.083	0.415
Dealer	-0.277	0.210	0.184
Importer	1.030	0.338	0.003 ***
Producer	-0.302	0.219	0.167
Heroin	0.561	0.079	0.000 ***

[15] The models use a natural logarithmic transformation of the degree and between distributions.
[16] For roles and drug types, we treated the categories as non-mutually exclusive as individuals can deal with more than one drugs and, similarly, they can perform more than one role.

Cocaine	0.316	0.089	0.001 ***
Cannabis	0.059	0.077	0.449
OCG member	1.193	0.141	0.000 ***
(Intercept)	0.459	0.271	0.552
R-square	*0.383*		
Model Sig.	*0.000*		

Note: Significance calculated using Y-permutations; significance levels: * < 0.10; ** < 0.05; *** < 0.01.

A higher level of degree centrality is the result of four main factors: dealing with heroin or cocaine (Class A drugs), being involved in the importation of drugs and being a member of an OCG. The effect of the latter is the strongest. These findings confirm the idea that Class A drugs tend to be associated with a higher structural complexity (see also above). Further, being in a position to import drugs into a territory gives a clear edge over people who are involved in the production or dealing. This resonates with the qualitative evidence about the workings of Class A drug markets:

> There is someone at the top who will import the drugs in, then you will have people that he or she trusts to give the drugs to, they will then give the drugs to somebody else who will then cut them and prepare them. The bottom tier are the runners who would go out on the streets (Interview 3).

Finally, even when controlling for all the other variables available, OCGs appear to exert some strong influence on the market—at least when measured through the degree centrality of the players (i.e., the number of connections established).

9. Conclusions

This article has explored the structure and mechanisms underpinning the network of suppliers operating in the local drug markets in a non-metropolitan setting: Newport, Wales. We did so by relying on police records supplemented with six semi-structured interviews with experienced police officers. The article has shown that, overall, the supply-side of local drug markets is a rather fragmented business, consisting of a large number of independent entrepreneurial actors or small cliques (this is in line with Natarajan et al., 2015; Bichler, Malm, & Cooper, 2017, also Dorn, Murji & South, 1992; Reuter & Haaga, 1989; Matrix Knowledge Group, 2007; McSweeney, Turnbull & Hough, 2008;). Yet, we also found a certain

degree of structural differentiation in the network both in terms of positions and roles. There are indications of some cohesive co-offending clusters and the presence of a few central and well-connected actors (only 2.4% of actors have more than 10 connections and 2.8% have between 9 and 5 connections). When considering the roles performed by offenders, there appears to be a very high degree of specialisation among suppliers with a separation between producers, importers and dealers (with only 2% of the actors having more than one role). Further, we unpacked the dynamics underlying different drug markets comparing the supply of heroin, cocaine and cannabis (the three main types of drugs in Newport as captured by police data). Substantial structural differences have emerged. Crucially, heroin and cocaine networks show a (relatively) higher level of density – and lower fragmentation – as well as a higher average degree than the cannabis network. This finding is consistent with the idea that dealing in such drugs requires greater cooperation and a tendency towards group formation. We conjectured that this could be the result of a higher need for protection due to differences in how drugs are traded, their customer base and the length and cost of supply chains (see also Coomber and Turnbull, 2007; Potter, 2009; Reuter, 2014; Coomber, 2015). The qualitative evidence from the interviews offers some preliminary support for our conjecture. These findings also warn us of the dangers of representing the overall drug market as a homogeneous entity (in line with Coomber, 2015).

Further, we found evidence that offenders tend to specialise in the type of drug they supply – particularly in relation to Class A drugs (only 5.7% of suppliers dealt with both cocaine and heroin). This suggests that switching between drugs or expanding into new drug markets is not an easy task and comes with considerable costs, e.g. establishing criminal contacts and developing distribution networks as well as the potential retaliation from existing players. Elements of territoriality have also emerged with very limited mobility among suppliers (the majority of them operate across just one 3-digit postcode area). These findings are in line with Reuter (1983, 1985) who suggested that illegal traders tend to specialise in a small number of products and limit their geographical scope.

Next, we studied the involvement of OCGs in the drug market. More than half of OCG members have dealt with heroin (57%) while a third has dealt with cocaine and less than a quarter with cannabis. Overall, this work has revealed that OCG members *do* possess significantly higher degree centrality than non-OCG members. This suggests that OCGs—or at least their members—occupy more central

positions in the market. This could be the result of a longer career in the trade, which would also explain the slightly higher average age for OCG members (a conjecture in line with Van Koppen, de Poot and Blokland 2010), as well as better access to resources, including contacts and protection.

Moreover, by formally modelling interactions, we were able to estimate what predicts for higher centrality in drug markets. We identified four main factors: dealing with heroin, dealing with cocaine, being involved in the importation of drugs and being a member of an OCG. These findings support the idea that Class A drugs tend to be associated with higher structural complexity. Further, they show that importers have an edge over other market players including the (local) producers. Finally, OCGs appear to be in a position to exert influence on the market – even when controlling for all the other variables. Illustrative evidence from the interviews supports – and circumstantiates – the node-level results.

Interviews cited in the text:

Interview 1. Detective Constable (20 years of experience)

Interview 2. Proactive Crime Investigation Department (5 years of experience)

Interview 3. Proactive Crime Investigation Department (14 years of experience)

Interview 4. Detective Sergeant (16 years of experience)

Interview 5. Detective Inspector (26 years of experience)

Interview 6. Detective Sergeant (22 years of experience)

Appendix

Table A1. Roles by drug type: Dealer, Production and Importation

	Dealer	Production	Importation
Only Class A	41% (180)	3% (6)	71% (5)
Only Class B&C	38% (166)	95% (188)	29% (2)
Mix	20% (89)	2% (4)	0% (0)
Colum Totals	*100% (435)*	*100% (198)*	*100% (7)*

Table A2. Degree centrality measures for supply network of drugs*

Degree Centrality	Percentage (Count) of Actors
17 (0.013)	0.2% (1)
14 (0.011)	2.2% (14)
8 (0.006)	0.3% (2)
7 (0.005)	0.2% (1)
6 (0.005)	0.5% (3)
5 (0.004)	1.8% (12)
4 (0.003)	5.2% (34)
3 (0.002)	6.6% (43)
2 (0.002)	12.5% (81)
1 (0.001)	25.1% (163)
0 (0.000)	45.5% (296)
Column Totals	*100% (650)*

* *Note:* Normalised Degree Centrality is placed in brackets

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